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2. Patent application number *(The Patent Office will fill this part)* 0313627.2

3. Full name , address and postcode of the or of each applicant *(underline all surnames)* F12 JUN 2003

   COGNIFEX LIMITED
   30 Trentham Street
   London SW18 5AT
   United Kingdom

   Patents ADP number *(if you know it)* 86517 88001

   If the applicant is a corporate body, give the country/state of its incorporation United Kingdom

4. Title of the invention
   CONTAINERS

5. Name of your agent *(if you have one)*
   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

   Williams Powell
   Morley House
   26-30 Holborn Viaduct
   London EC1A 2BP

   Patents ADP number *(if you know it)* 5830310001

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Country	Priority appliation number *(if you know it)*	Date of filing *(day / month / year)*

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Number of earlier application	Date of filing *(day / month / year)*

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11. I/we quest the grant of a patent on the basis of this application.

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Date 12/06/03

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Mr Lee Anderson 020 7936 3300

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CONTAINERS

The present invention relates to containers.

There is a great deal of competition between manufacturers of different brands of product to attract their target consumers. Manufacturers do not just rely on the qualities of the products themselves, but design the containers in which products are packaged to attract the consumer. This can be achieved in many ways, for example by colourful or eye-catching labelling or by the design of the shape or style of the container itself. This may apply in particular where the container is integral with the product itself, for example a container in which foodstuffs or drink may be held.

The present invention seeks to provide significant visual indication to a consumer on opening, or other handling, of a container.

Many containers especially those in which foodstuffs are packaged, are designed to communicate information relating to the safety of their contents. For example, the lids of jars do not "pop up" until opened, thus indicating whether or not they have previously been opened. The present invention also seeks to provide an alternative indication that a container has not been previously opened.

According to a first aspect of the present invention there is provided a container including light-emitting means, event-detecting means, a power source, and connecting means for connecting the light-emitting means with the event-detecting means and the power source, such that light is emitted on detection of an event, wherein the container is at least partially fabricated from a material able to transmit light.

The activating event preferably comprises the opening of the container.

Preferably the container is portable.

The light-emitting means preferably comprises a light-emitting diode (LED), as LEDs have low power requirements.

The connecting means preferably comprises an electric or electronic circuit, and the event-detecting means preferably comprises the opening or the closing of the circuit.

According to a second aspect of the present invention there is provided a container containing a consumable product, including means for producing a sensory stimulation, means of detecting opening of the container, a self-contained power source, and connecting means for connecting the means for producing a sensory stimulation with the means of detecting opening of the container and the self-contained power source, such that on opening the container the power source causes production of a sensory stimulation.

Preferred embodiments of the present invention are described below, by way of example only and with reference to the accompanying drawings, in which:
Figure 1 is a cross-section of a bottle in accordance with a first embodiment of the present invention;
Figure 2 is a diagram of an electronic circuit incorporated in the bottle of Figure 1;
Figure 3 is a diagram of an electronic circuit of a second embodiment of the present invention;
Figure 4 is a diagram of an electronic circuit of a third embodiment of the present invention;
Figure 5 is a diagram showing the arrangement of the terminals of a fourth embodiment of the present invention; and
Figure 6 is a diagram showing the arrangement of the terminals of a fifth embodiment of the present invention.

Figure 1 shows a bottle 10, which contains a beverage, sealed by a cap 11. The bottle is fabricated from a translucent material. The bottle has an indentation 12 in its base, in

which are situated an LED 13 and coin cell batteries 14. The LED 13 and batteries 14 do not extend below the base of the bottle 10 ensuring that the bottle can rest in a stable manner on its base.

A transistor switch circuit 20 is located on the external surface of the bottle and covered by a label (not shown). Electrical conductors 15 for the circuitry are situated on the external surface of the bottle and extend to the cap 11. The control circuitry is implemented with surface mount components. The current requirement and power dissipation of the necessary devices are minimal for low current illumination; the control circuitry is therefore small and unobtrusive.

Figure 2 is a circuit diagram of the transistor switch circuit 20 incorporated into the bottle of Figure 1. The LED 13, batteries 14 and terminals 21, 22 are connected through the circuit via the conductors 15. The terminals 21, 22 are electrically connected together by a conductive cap 11 of the bottle 10 when the cap is applied to the bottle during manufacture. Bipolar junction transistor BJT 26 and field effect transistor 27 act to open or close portions of the circuit depending on its status. The batteries 14 are 3 Volt batteries.

First, second and third resistors 23, 24, 25 are employed to regulate the current. Typical resistance values in Ohms are shown in Figure 2. The first resistor 23 limits the current through the LED to 32 mA. The third resistor 25 allows sufficient charge to build up in the field effect transistor (FET) gate region, unless the terminals 21, 22 are closed in which case all the current in the resistor 25 flows back to the batteries 14. At this point the maximum voltage (Vgs) that can occur across the gate and source is equal to the voltage across the base emitter junction of the bipolar junction transistor. Since this is well below the gate threshold voltage the FET ceases to allow current to flow from its drain to its source, therefore inhibiting current into the base emitter junction and so shutting off the transistor 26 and stopping current flowing from its collector to its emitter. The circuit thus goes into standby.

When the terminals 21, 22 are open the gate charges up via the third resistor 25 and so causes current to flow from its drain to its source via the second resistor 24. The second resistor 24 therefore limits the current being fed into the base emitter junction. The actual amount of current required here depends entirely on the bipolar junction transistor used. When the bipolar junction transistor 26 is fully turned on and is in saturation, current will flow through the first resistor 23 and the LED 13 thus providing illumination. The first resistor 23 limits the current through the LED 13 to prevent it being damaged by excessive current.

A leakage current of 1.3 μA flows from the batteries through the third resistor 25, through the closed terminals 21, 22 and back to the batteries 14. The current is maximum when the batteries 14 are fresh and nominally equal to 3 Volts each.

In use, the bottle is of "normal" appearance before opening. On opening the bottle of the embodiment of Figures 1 and 2, the electrical circuit through the cap is opened. This causes closure of the LED circuit path and emission of blue light by the LED. In this embodiment, the effect lasts for about 20 minutes depending on the lifetime of the batteries.

There are various advantages of the above-described arrangement. Manufacturers may wish to visually enhance containers for many reasons, including product promotion, advertising, point of sale, competition based campaigns and general marketing purposes. It could be particularly useful for launching a new brand. "Seasonal" promotion may be desired at certain times of the year (Christmas, for example). This type of visual enhancement could be used to target specific consumers. For example, it may attract women to drinking beer.

Although there would be an initial setting-up cost to provide containers as described above, on a large-scale the cost of production will be extremely small. Current manufacturers would be able to easily adapt their facilities in order to produce such containers.

There are various modifications that can be made to the above-described embodiment. It is particularly envisaged that the bottle contain an alcoholic beverage such as an "alcopop" or beer, although, as described below, depending on the purpose for which the present system is used the contents may be anything, solid or liquid, ranging from foodstuffs to toxic or hazardous substances. The invention can be used in other types of containers, for example, jars, packaging boxes or cans that are at least partially translucent or transparent.

Alternative embodiments of the invention may include a cap that is replaceable. In particular, replacing the cap could cause opening of the LED circuit, and cessation of light-emission. In this way, containers can be designed to communicate information relating to the safety of their contents or the status of the container itself, particularly where the contents are hazardous, volatile or perishable. For example, the LED may be activated if the lid of a product is not on properly (for example, on medicine bottles where child-proof tops are not on properly, or on containers containing hazardous or degradable materials). Alternatively, activation of the LED may indicate previous opening of a jar, can or bottle in a supermarket (and thus product tampering). An advantage of this system is that the consumer can tell whilst a jar is still on the shelf in the supermarket whether it has previously been opened; they will not need to wait until opening the product at home, after it has already been bought.

Preferably, in such "safety" applications, the LED would emit light for longer than 20 minutes. This can be achieved, for example, by inclusion of timing circuitry, which switches off the LED after a specified period of time. Alternatively, use of a flashing light could save energy and therefore allow the illumination effect to last for longer. In cases where the LED has been activated for too long whilst the container was still in the

supermarket and the batteries have run down, failure of the container to light up on opening at home could also indicate a problem with the contents.

Removal of the lid of the container is not the only activating event that may be detected in order to activate light-emission. Depending on the configuration of the circuit, other examples of activating events may be envisaged. A switch on the base of the container that is depressed when the container is placed on a surface, but released when the container is picked up by a user would result in visual enhancement of the container whilst it is in use. If employed in a bottle of drink sold in a bar, this could encourage people to drink more quickly and therefore buy more of the product. Such an embodiment may require an initial activating event (for example, removal of the cap), with the automatic base switch being a secondary activating event. The exemplary circuit illustrated in Figure 2 could be easily adapted by one skilled in the art to carry out this function.

Other examples of activating events include breaking a seal, tearing off a label or a strip, replacing a label, tilting of the container (for example, whilst drinking from a bottle), change in the level of the contents, change in temperature or exposure of a product to a particular temperature for a period of time longer than specified in Health and Safety regulations, change in pressure, magnetic field, or through tampering with the container or its contents. Of course, a manually activated switch could also be used to activate light-emission.

The first resistor of the circuit shown in Figure 2 may be omitted, or included as a precautionary measure. It is possible that in this application, if only two 3V cell batteries are used, the LED could be connected directly across the series connected batteries, and the batteries themselves would not provide enough current to damage the LED.

Figure 3 shows an alternative circuit that could be used with a second embodiment of the present invention. When the gate and source of the n-channel MOSFET 39 (2.26 μW dissipation) are shorted then Vgs=0, and only a very small leakage current can flow

through the MOSFET channel 39, the PNP base-emitter junction 46 (6.14 mW dissipation), resistor 23 and resistor 24. This is insufficient to cause any significant current flow from the emitter to the collector of the PNP bipolar junction transistor 46. When the short on the gate and source is removed, a greater leakage current flows through drain and source and thus through the base-emitter of the transistor 46 as some charge builds up on the gate via resistor 25 (90 mW dissipation) and resistor 33. The transistor 46 turns on very slightly allowing current (35 mA) to pass through to the LED 13. Consequently a potential is developed across transistor 46, thus lifting the gate voltage further, allowing more current into the base of the transistor 46 and causing more current flow through the LED 13. This feedback effect rapidly causes both transistors to saturate, thus passing maximum current through the LED 13, limited only by the LED's series resistor 25. Placing the short back across gate and source shuts off the MOSFET channel 39 current so preventing flow through the base-emitter of the transistor 46 and so also shutting this off. This process can be repeated. The main advantage of this circuit is that the leakage current is in the region of 50nA. This is more than 50 times less. Other configurations are possible.

Figure 4 shows an alternative circuit that could be used with a third embodiment of the present invention. The circuit includes general purpose medium gain (300+) bipolar junction transistors 46, 47. With either of the sets of terminals 21, 22 or 41, 42 closed, the current flow is switched off. For example, if terminals 41, 42 are shorted then Vbe of NPN bipolar junction transistor 47 = 0V, and there is therefore no current through the collector-emitter junction of transistor 47. Not only does this stop the current flow through the second resistor 44 and the LED 13, it also stops current through the third resistor 45 and hence the base-emitter junction of transistor 46, therefore also turning PNP bipolar junction transistor 46 off. A similar situation arises if terminals 41, 42 are left open and terminals 21, 22 are closed. When both sets of terminals 21, 22; 41, 42 are open then both transitors 46, 47 turn on and saturate. The first resistor 43 and the third resistor 45 control the base currents and hence the collector-emitter currents, which can only pass through the second resistor 44 and the LED 13 The maximum current through the second resistor 44

and LED 13 is determined by the lower β (DC current gain) value of the two BJTs 46, 47. With fairly well known β values it is possible to omit the second resistor 44 and to control the LED current just with correctly selected values of the first and third resistors 43, 45. Each BJT 46, 47 acts as a switch and a current source for the other. With one set of terminals closed the leakage current is in the order of 300nA, but this depends on the BJTs chosen. With both sets of terminals 21, 22; 41, 42 closed, however, leakage is in the order of 5nA. When both sets of terminals 21, 22; 41, 42 are closed, the equivalent circuit is of two resistors and a reversed biased LED in series. The advantage of such a configuration is that a current can be turned on with an open switch and off with a closed switch, and battery life is extended in comparison with other configurations. It has also been determined by experimentation and simulation that a moderately poor contact of 100 Ohms will still operate the circuit perfectly and that moisture across the open contacts has negligible effect. This circuit does not have to be run from batteries and has many other applications. This circuit can be fully realised in silicon by using BJT or FET current control in place of the resistors, for example.

In use, the embodiment of Figure 4 will function when either of the sets of terminals is open. For example, depending on the desired application, one set could act as a safety contact, preventing unwanted activation should the cap of the bottle be damaged during transportation.

The event-detecting means preferably comprises the opening of the electric circuit, as illustrated in the embodiments of Figures 1 to 4. However, other methods of achieving this can be envisaged. Moreover, the event-detecting means may comprise the closing of the electronic circuit.

Figure 5 shows the neck of the bottle 10 and cap 11 of a fourth embodiment. In this embodiment, a strip of insulating material 51 is attached to the cap 11 of the bottle 10 and separates the electrical terminals 21, 22. Opening of the bottle causes removal of the insulating strip and hence closure of the circuit.

Figure 6 shows the neck of the bottle 10, and cap 11 of a fifth embodiment. In this embodiment the terminals 21, 22 are biased towards each other, but kept apart by air pressure where the bottle 10 contains a pressurised or carbonated drink. The terminals are housed within a tube 61. On removal of the cap 11, the pressure in the bottle drops, and the terminals come together thereby closing the circuit.

However, the embodiment of Figure 3 could be modified such that it is a conducting strip (rather than an insulating strip) that is removed on opening the container. Equally, the terminals in Figure 4 could be biased away from each other but electrically connected by vacuum pressure in a vacuum sealed container. Therefore either of these embodiments could be used with the circuit of Figure 2, where the event-detecting means is the opening of the circuit.

Other embodiments may utilise alternative methods of detecting activating events. These may be, for example, inductive or capacitive coupling, change in capacitance, contacts in any removable section of the container, direct contact with container contents, temperature activation, tamper activation, via receipt of an external signal (it could be infra red or radio frequency or other, by the known methods of modulating a carrier frequency) or other electromagnetic method.

Initial activation methods are many and varied as already covered and subsequent changes to the activated effect can also be implemented by inductive, capacitive, field effect, human body aerial effect or human body conduction. Second/third etc stage effects can obviously be additionally implemented.

The power source may comprise various types of battery, including rechargeable batteries or photoelectric cells. The power source may also comprise clockwork generation. The value of the second resistor can be decreased in order to decrease sensitivity to moisture across the terminals, and thereby preserve the life of the power source. The circuit is not

sensitive to moisture when the effective switch contacts are closed. Moisture will not affect it when in this standby state. Moisture can affect the operation when the contacts are open as the input impedance of the FET gate is extremely high and any current flowing through continuous liquid or wet hands will start to shut off the control current into the bipolar junction transistors, proportionally. This is also what makes it possible to shut it off so effectively for good shelf life. It should be noted that this aspect can be controlled to some degree by having the contacts on opposing sides of the bottle. The power source need not be situated within an indentation in the base of the container, but could be at any suitable location of the container. For example, a photoelectric cell could be located in darkness under the lid of the container. On opening the container, and exposure of the photoelectric cell to light, the current required for light-emission from the LED is generated.

The best effect is obtained from a container fabricated from a translucent material such as frosted glass, or having translucent contents, because of the diffusing effect on the emitted light. However, transparent containers or contents may also be used, especially for purposes other than visual enhancement. The whole container may light up, or selected parts of it may light up. The illumination effect can be made time variable so the effect lasts for or starts after a specified period of time or after specified conditions have occurred.

Other embodiments may utilise incandescent, fluorescent, semi-conductor or other electrically activated illumination devices. Chemical illumination may also be implemented.

Any colour of LED may be employed. It is preferred that clear lens LEDs are employed so that colour of the emitted light cannot be determined until after activation has occurred. This is particularly relevant where this system is employed for a promotional competition (for example, a limited number of "winning" containers may emit a different colour to regular containers). Location of the LED "non-specifically" in the base of the container

gives a good overall illumination effect. The LED may be located at any other part of the container for a non-specific illumination effect. The container may be continuously lit or any combination or pattern of flashing illumination of the whole container or contents or parts of the container may be employed. In particular it may be desirable independently to illuminate a logo or other symbol on the container by embedding the LED within that specific part of the container rather than non-specifically at the base of the container or by use of surface mount LEDs. Images, logos or other symbols may be projected from the container.

If the necessary changes to the first resistor are made, the circuit can be applied to LEDs with lower voltage drops. Moreover, if a short-lived effect is required, the first resistor can be employed to increase the current thereby increasing the brightness of the light emitted by the LED, and at the same time reducing battery life.

Multi-coloured illumination effects may be achieved using one or more light sources. The wavelength of the emitted light may be from the visible part of the electromagnetic spectrum, or may be non-visible, such as ultraviolet light. The effect may result in the contents of the container appearing to change colour.

A liquid crystal display (LCD) device may be used; for example, an LCD may be embedded with a message.

Conductors may form an integral part of a label or be attached to the container. The conductors may be situated on the internal or external surface of the container, be embedded into the material of the container, or be a part of the container, or a combination of these. The moulding of the container can be designed to accommodate these features. The control circuitry may or may not be in direct contact with the contents of the container depending on the specific application.

The transistor switch circuit could be located on the internal or the external surface of the container. It could be located within a moulded indentation of the container, or embedded into the material of the container. It could be hidden under, or attached to the back of a label.

In an alternative embodiment, sound (for example, the playing of a signature tune, or an alarm buzzer) could be activated instead of, or in addition to, an illumination effect.

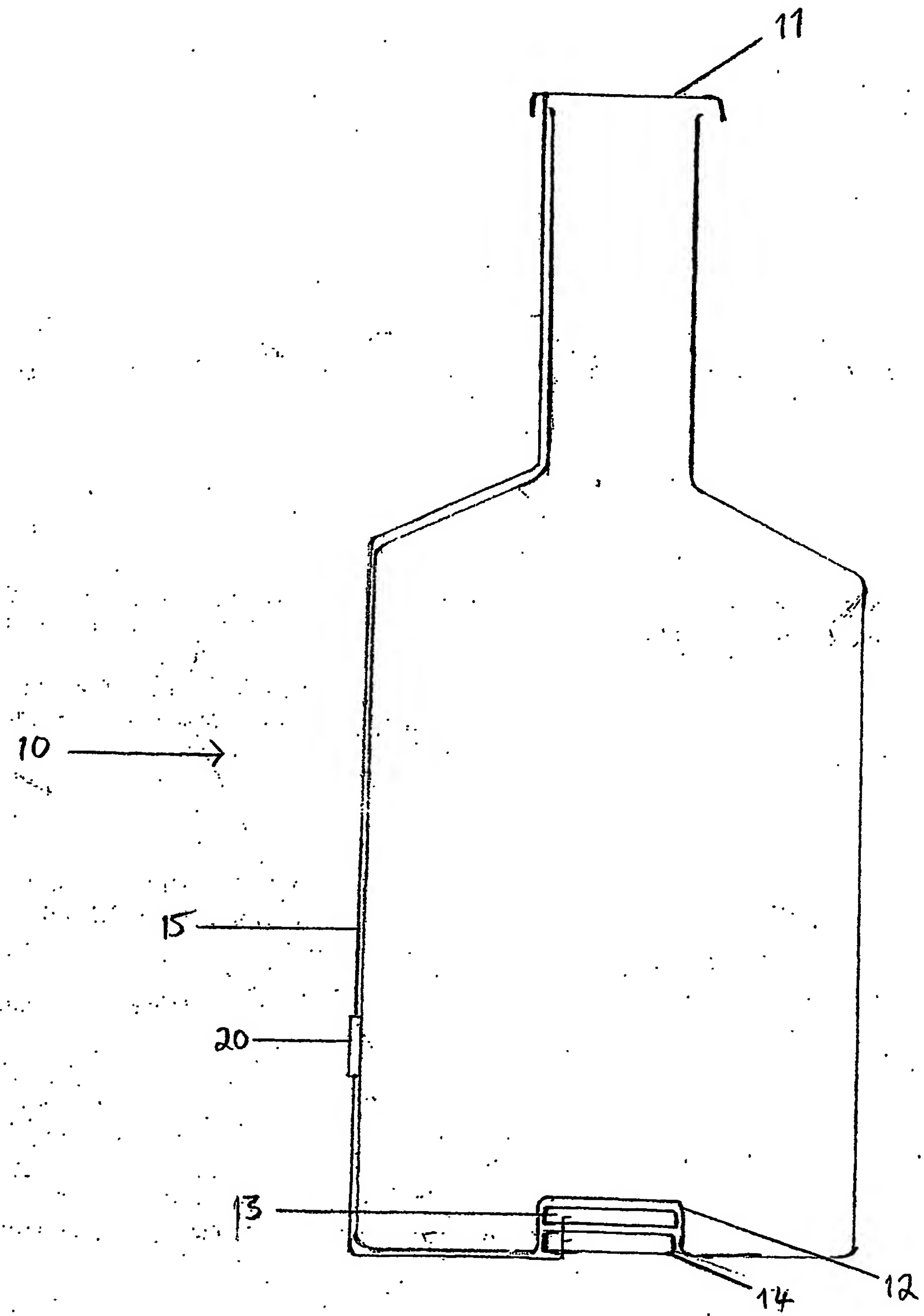

Figure 1

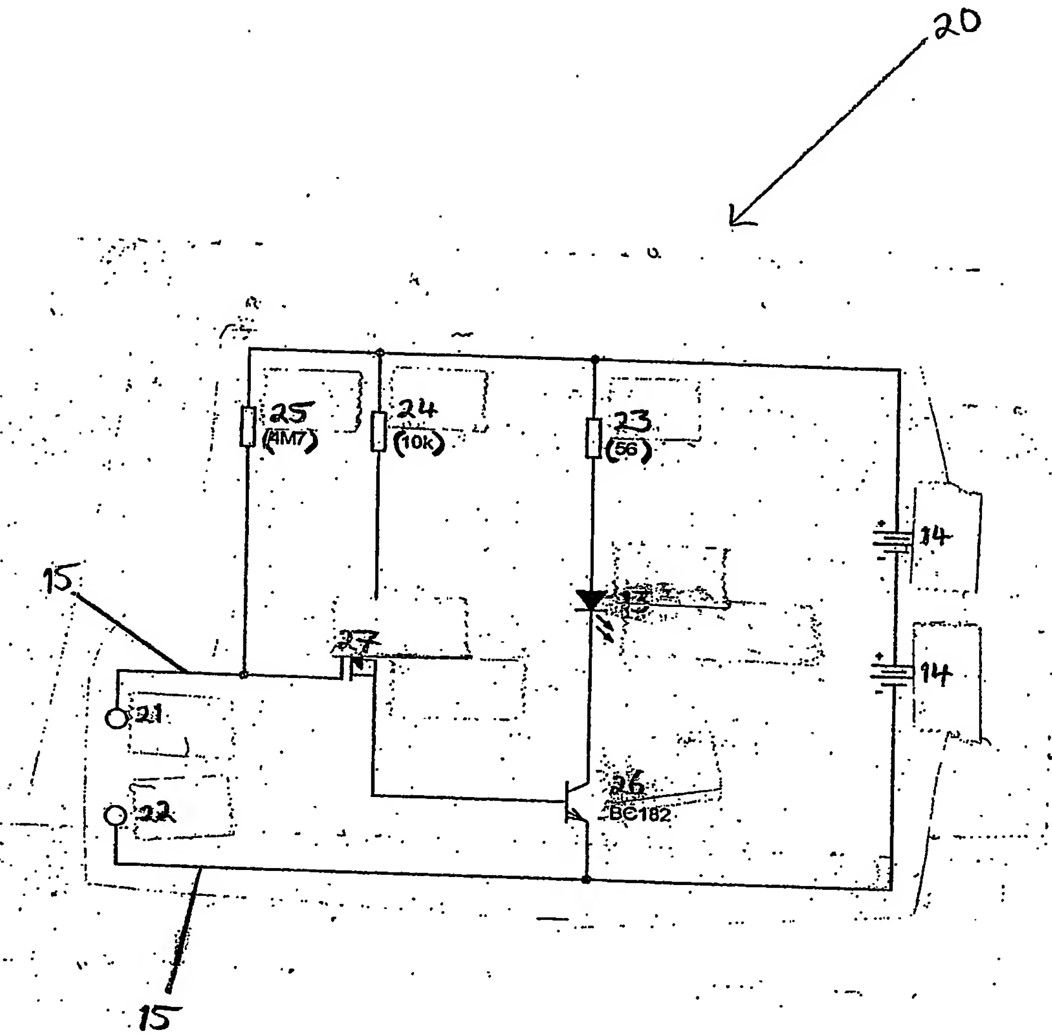

Figure 2

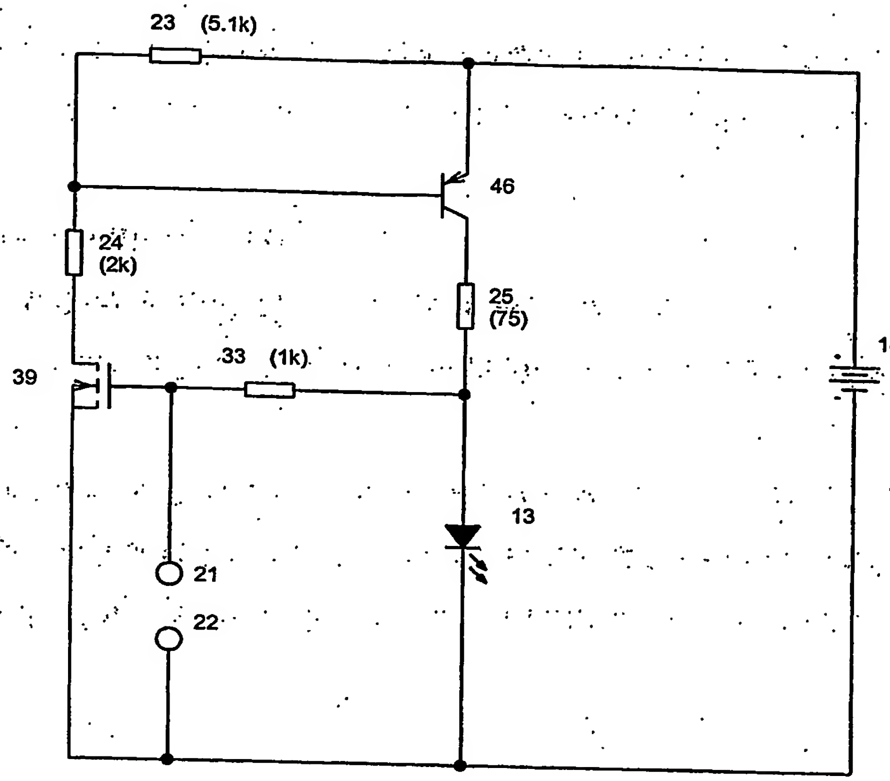

Figure 3

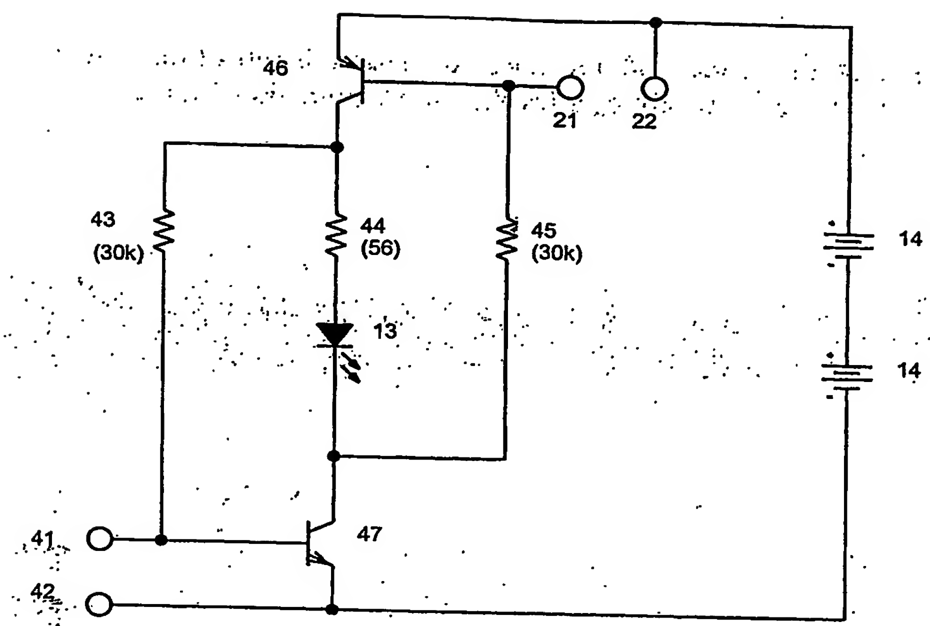

Figure 4

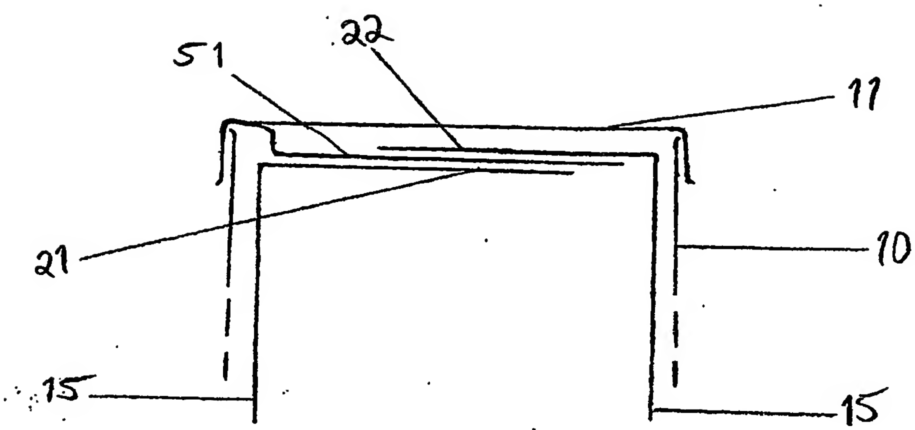

Figure 5

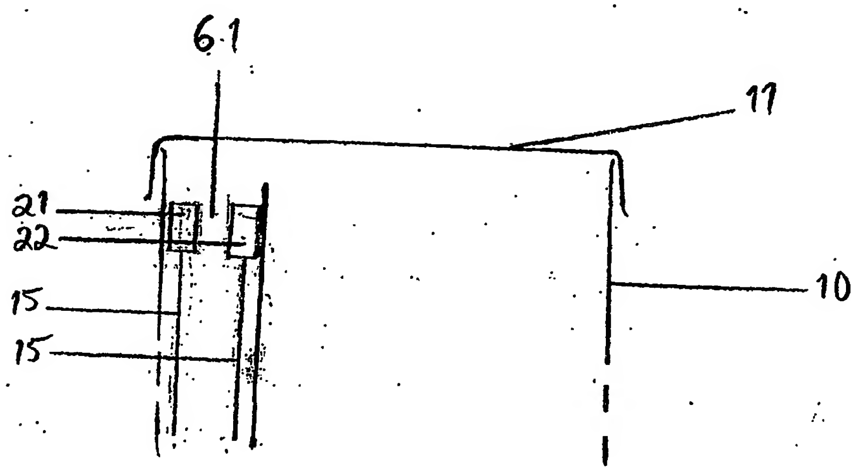

Figure 6

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